The Engineering News.

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THE SITUATION.

The year just closed has been a season of "hard times" for American Engineers and Surveyors. The general cessation of railroad construction, and of city and suburban improvements, that followed the financial panic of 1873, was, to very many of them, the beginning of a period of forced inactivity, the end of which is still indeterminate, while to many more it greatly reduced the demand for their services and correspondingly diminished their incomes. But Civil Engineers are familiar with intervals of "nothing to do;" they are not unfrequently obliged to suffer the loss of their earnings by the failure or dishonesty of the individuals or corporations employing them; they are often exposed to sickness and disease, and are otherwise subjected to the ordinary ills of life; they are usually, however, men of more than average intelligence, and possessed of large practical ability; apt to devise and prompt to execute expedients to meet every emergency. We believe, therefore, that the great body of the engineering profession of this country are, at the present writing, better prepared to await, with a contented philosophy, the return of better days, than are our debt-burdened merchants, manufacturers and speculators.

But the profession has not been idle. Partially relieved from the pressing demands of active duties, many of the engineers of the highest grade in the country have given increased attention, during the past year, to the intellectual needs of themselves and their less prominent professional brethren, and have inaugurated a period of scientific investigation of subjects of practical utility, that must ere long result most beneficially to the industrial, commercial, and social interests of the country.

Stimulated by the example of kindred associations in Europe, the Civil Engineers' Societies of the United States have made great progress in the past twelve months, and the "American Society of Civil Engineers," with headquarters in New York City, has attained to a national reputation. Its list of members exhibits an array of engineering talent second to none in the world; the papers that have been read and discussed at its meetings are most valuable acquisitions to engineering literature; the subjects of investigation on which their committees have been appointed, are of national importance.

The Civil Engineers' Club of the Northwest, with headquarters at Chicago, after several years of struggling for mere existence, during the past year developed considerable strength, and at its close, gives promise of future growth and usefulness. A number of valuable papers were read at its monthly meetings, and an interest has been awakened that, we trust, will not soon abate.

Of the Engineering Societies in St. Louis and San Francisco, we have no knowledge, but the names of some of the members of each are guarantees that something has been accomplished by them, and that they have contributed their share to the general advancement of the profession. The Technical schools of the country have been well patronized during the past year, and the most prominent of them, the Stevens Institute of Technology, at Hoboken, N. J., under the tuition of such able teachers as Prof. R. H. Thurston and De Volson Wood, has become so overcrowded that it is expected that the class entering next year will be restricted in number by a competitive examination, and that the charges for tuition will be made nearly equal to those of other Technological schools. It is to be hoped that the young men graduating from these institutions will do honor to their chosen profession, and in time purge it of much of the odium of incompetency that now rests upon it.

Of Engineering operations in 1874, there is not much to chronicle. The most important, the Illinois and St. Louis Bridge, was completed and opened for traffic on the 4th of July last; work has progressed on the Hoosac Tunnel, and on the East River Bridge; the question of Rapid Transit in New York City is approaching a practical solution by the progress of the Underground Railway, of which the 4th Avenue portion is nearly completed; the drills have been kept pegging away at the Hell-Gate obstructions; some railroad extensions have been completed, the most important being that of the Baltimore & Ohio R. R., to Chicago, and some new roads have been commenced. In Chicago, the new Water Tunnel has been finished from the shore to the crib, two miles out into Lake Michigan, and the portion under the city, about three miles long, is being rapidly pushed to completion. The Fullerton avenue conduit, intended to cleanse the North Branch of the Chicago River, by turning the waters of Lake Michigan into it at the Northern limits of the city, progressed well during the summer months, but the contractors having lost money on the job, are now endeavoring to influence the Common Council of Chicago to grant them a large increase over the contract price, and pending the result the work is stopped, and the North Branch remains unpurified. There have been other important civil and mechanical engineering operations, and in surveying, the Hayden and Wheeler expeditions, the U. S. Coast Surveys, besides the other regular field work of the Government, while in Europe the most important undertaking is that of the St. Gothard Tunnel under the Alps.

But what about the future of Engineering? In answer we would ask our readers to trace out on a map of the world, the countries whose people are familiar with the application of that most marvelous agent of civilization, Steam. They are to be found on the continents of Europe and North America, and in number are less than half a score, while their total populations are but a fraction of the many millions of people who are awaiting the introduction among them of the great civilizer. To say nothing of the South American States and Mexico with their 40,000,000 of population, even Russia and Hungary are comparatively without railroads, and much less have these countries learned to employ steam in their various manufacturing processes, and now China, Japan, India, Brazil and other South American countries with their immense populations are showing a marked inclination to encourage internal steam transportation, while every careful observer of the indications of the present times can discern the signs of an awakening of a commercial spirit all over the world which ere long will break down the barriers of exclusiveness that have hitherto prevented the free intercoure of nations and a period of public improvements will be inaugurated, such as heretofore has been scarcely imagined.

Engineering is the science of civilization and must ever be in the van. The time is not far distant when the services of Civil Engineers will be greatly in demand. And while English, French, and German Engineers will largely control certain territories, yet to American talent there is a vast field opon, and it behooves them to be ready to take advantage of each opportunity as it is presented. A little thought given to the subject will bring to their minds the many fields of enterprise that are open; let them see to it that by study and investigation, they are prepared to respond to the call for their services, and by their works demonstrate their ability to add new honors to the noble profession which they represent.

COUNTY SURVEYORS.

From nearly every one of the public land States we have received letters on the subject of the County Surveyor's office and in nearly every instance the writers were County Surveyors, and if we may judge from their written communications, were men of considerable intelligence and abilities. Their testimony is, that the yearly income of County Surveyors ranges from $150 to $500, and in very rare cases reaches $1000; this insufficiency of income is the great barrier to improvement on the part of the surveyors, as they do not feel justified in buying high priced instruments and so use the cheapest and rudest obtainable; they cannot buy books and so make no advance; and they have small encouragement to give the subject of careful surveying any thought, preferring rather to cultivate a few acres of land: write conveyances; solicit insurance; drive a stage, or attend to various other kinds of business from which they can get away at any time for a day or two, to do odd jobs of surveying for the farmers.

The office is a political one, and is frequently filled by men ignorant of the simplest rules of surveying and who turn the business over to deputies perhaps as ignorant as themselves; there is no responsibility attached to the office and it is an unusual thing for succeeding incumbents to agree in their measurements or courses. A great variety of opinions

respecting the methods of running certain lines exists and no intelligent attempt has yet been made to ensure uniformity; the consequence is that opportunities for litigation are constantly being created through the ignorance and stupidity of land surveyors.

The laws relating to surveys and surveyors are very loose, and intelligent legislation concerning them is exceedingly rare; the men who make the laws have no practical knowledge of what is needed and when they appeal to the surveyors for assistance, they find but poor encouragement. Why there should be a County Surveyor any more than a County Doctor or Parson, we do not see, without it is that the bodies and souls of the people have less need of correct adjustment than their land lines? The senselessness and uselessness of the office is recognized in the most intelligent States by amending the law so as to allow any "competent surveyor" to make surveys and subdivisions, and it would be well if this fact were generally known and recognized, and the office of County Surveyor be allowed to go unoccupied and gradually be forgotten, while active competition drove the army of "incompetents" to their legitimate occupations, leaving the field to the best men, who, located in the most thriving towns, would demand and receive fair pay for their services, and secure as extensive a patronage as their individual influence could obtain. Under the present system individual merit counts for little or nothing, as the fact of such an office as the County Surveyor actually existing leads most of men to the conclusion that the incumbent is the only authorized man to make surveys, and further than that they do not inquire.

Connecticut is the first State to abolish this office. There, it was not the same adjunct to the land system as in the public land States and so could be easily done away with. By the newly revised statutes of that State, the office of Surveyor General and County Surveyor are abolished, as it was found that they amounted to nothing, as why should they, the legal fee being—one dollar and fifty cents per day—less than hod-carriers wages. We can hope for no such change being made west of the Ohio River, but by the united action of the intelligent portion of the profession there may be secured some legislation looking to an improvement on the present system. What that might be we will leave for future consideration. The legislatures of most of the States are now in session. Cannot action be commenced at once.

CORRESPONDENCE.

WONEWOC, WIS., Dec. 16, 1874.

MR. EDITOR:

In the November number of THE ENGINEER, ARCHITECT AND SURVEYOR, is a communication from Mr. R. L. Hall, of Oconto, Wis. I must say that I was much amused (and yet my merriment had connected therewith a tinge of regret) to learn that Mr. Hall still carries upon his mind that great burden: *The proper subdivision of a fractional section.*

Perhaps to no other man does his article appear as to myself; to me it is the revival of old times, the bringing back of years that have passed—the resuscitation of a question which I thought had been definitely settled years ago.

I propose in this communication to deal with the matter of "*fractional sections, when no opposite corresponding corners have been or can be established,*" and to give a short history of the connection of Mr. Hall and myself with the matter, leaving the other matters of the establishing of half-quarter and quarter-quarter corners to some other time.

In the spring of 1869, I was sent for by Judge Ingalls, of Menominee, Mich., to come to that place and establish some disputed lines. I went, and found the lines to belong to the class herein debated. I established some of them according to law, when, the lines not agreeing with the surveys made by Mr. Hall, and others, considerable interest and discussion were created concerning the matter. For the purpose of explanation I addressed the following letter to the local newspaper:

EDITOR HERALD:—As I hear considerable talk concerning the fact that some surveys made by me do not agree with previous surveys, I wish through your columns to let the people know that I am not having any dispute with any one; I am simply running lines according to United States law, and under full instructions from Hon Jos. S. Wilson, Commissioner of the General Land Office. If lines thus run do not agree with previous lines, whose fault is it?

In order that any one who will take the trouble to read this letter may fully understand the matter, I will quote the law, and decision of the Commissioner.

In Sec. 2, of the Act of Congress approved February 14th, 1805, I find:—

"The boundary line which shall not have been actually run and marked as aforesaid, shall be ascertained by running straight lines from the established corners to the opposite corresponding corners; but in those portions of the fractional townships where no such opposite corresponding corners have been or can be fixed, the said boundary lines shall be ascertained by running from the established corners due north and south, or east and west, lines, as the case may be, to the water-course, Indian boundary line, or other external boundary of such fractional township."

In a letter received by me from the Commissioner above mentioned, dated August 14th, 1869, he says:

"I have to inform you that in the subdivision of fractional sections, where there is but one corner to indicate the proper position of the subdivision line, the object of adjusting the compass to a variation which will retrace the section line, is to enable the surveyor to unmistakably identify the quarter section corner, re-establishing the same if necessary, but the subdivision line from this corner must be extended, as provided by Sec. 2 of the Act of Feb. 11, 1805, *due east, west, north or south* as the case may be; thus in the extension of the subdivision line from the corner "C," Fig. 1, in your letter, the course should be at a right angle from *the true meridian*, and not at right angle from the section line running from "A" to "B." The subdivision from the corner "C," in Fig. 2, in your letter, should be run *due south.*"

Fig. 1 was a representation of Sec. 2 and Fig. 2, of Sec. 3, T. 31 N., R. 27 W., Mich., and the corners marked "C," the quarter stakes on the west and north, respectively.

The above decision covers all possible cases where subdivision lines have but one corner to indicate their positions; and, of course, when I am called upon to run any of these lines, which have previously been run on some other principle, my line is in a different place from the former line. For instance, a line run, South 88 deg. 50 min. East, would not be retraced by a due east course; nor a line run South 2 deg. West, by one run due south.

The fact that I find lines which should run due east, running on different courses—now south of east, then north of east—is the only commentary necessary, on the wisdom of the above law; without it, there could be no legal settlement of these lines.

I write this in defense of the lines which I have established, and not in a spirit of controversy. It will also be much more convenient, for me to carry the next issue of the HERALD in my pocket, and hand it to this one and that one to read, than to explain this whole matter from one to half a dozen times per day. Very Respectfully,

HIRAM W. BARNEY.

The foregoing called out Mr. Hall as follows:

OCONTO, OCT. 11th, 1869.

EDITORS MENOMINEE HERALD,
MENOMINEE, MICH.

GENTLEMEN:—I shall esteem it a favor if you will permit me through your columns to make brief reply to the communications from Hiram W. Barney, Esq., relative to surveys in your vicinity.

Having no doubt myself as to the correctness of any of those surveys which I had completed, I did not feel it necessary to hasten to defend them; should Mr. Barney succeed in disturbing the confidence of the parties who employed me, I presumed I should hear from them and that then would be the proper time to defend my work.

A letter received this evening from a friend at Marinette, expresses surprise at my silence, and informs me that it is construed to my disadvantage.

Mr. Barney assumes that his predecessors have misconstrued, or been ignorant of, the Act of Congress approved Feb. 11th, 1805, the material part of which was quoted in his last published letter. A moment's thought will convince any well informed person that an act of Congress of so much importance would be widely known, and so it is. I have carried a copy of it over thirteen years, and during that time have availed myself of every opportunity to learn the practice of our best North-Western surveyors, and the construction of the act, and especially that part of it relative to the subdivision of fractional sections.

A very great majority of the best surveyors in Michigan and Wisconsin and other States reject the construction preferred by Mr. Barney.

I make this statement after having addressed letters of inquiry to them, upon this particular point, to which I have received answers.

The county records in some of the most important counties in the states mentioned show that the practice of running "intermediate courses" is a well established one. So far as I can learn the courts have sustained this practice without exception.

William A Burt who, as an authority upon all matters connected with Government surveys, may be quoted—with all proper deference to opposing authorities—in his "Key to the Solar Compass, and Surveyor's Companion," at page 74, says:

"Fractional section lines which close on meandered rivers and lakes, or on reservations, etc., are required by law to be run north and south, or east and west, as the case requires. These lines like those before mentioned in the subdivision of townships into sections, may not precisely agree with the cardinal points of the compass. Therefore, in subdividing fractional sections embraced by fractional section lines, which close on meandered streams, lakes, etc., the quarter section lines should be run with an intermediate course between the section lines; and the fractional quarter sections thereof, should be divided in like manner." And then gives the whole act in question.

I have collected a great deal of valuable information bearing directly upon the point at issue, which cannot be given here, but which I shall be pleased and ready to lay before any one who may deem it worthy their attention.

In conclusion, I would say that I proceeded with the greatest care and pains-taking caution in the subdivision of Section 2, T. 31, R. 27, and have an unshaken confidence that the lines which I established will be found correct.

I held the office of Deputy County Surveyor, for Menominee Co., at the time, and kept at my own expense a very full, complete and valuable record of all the work done as such deputy.

Very truly yours,
RICHARD L. HALL,
Surveyor.

There then followed a discussion of this matter which branched out and appeared in newspapers in Green Bay, Oconto, Menominee, Escanaba, and Marquette. And, as Mr. Hall says, he has corresponded extensively on the subject. His intention in our controversy and in his labors since seems to me to be, to try to gather an array of the *practice of surveyors* which

shall be so formidable as to supersede the law and the decision of the General Land Office.

In our controversy MR. HAWES, who for several years had charge of the surveying operations of the United States Government, and is author of "Hawes' Manual of United States Surveying," &c., &c., wrote me a letter which was published by the local paper editorially as below, which covers the ground in much better manner than I could discuss it myself, and, I think, ought to dispose of the matter.

WASHINGTON, Nov. 13, '69.

Hiram W. Barney, Esq.,
County Surveyor.

Sir:—I am in receipt of your letter of the 8th inst., in regard to the question under discussion in your section of the State, as to the proper mode of subdividing fractional sections of land under the laws of Congress and the government system of surveying.

I have not the time at present to refer to other authorities than the laws enacted by Congress, and the uniform ruling of the executive department of the government having charge of this subject; indeed, it would seem that these ought to be quite conclusive in the matter. I think they sustain the position you have taken.

When the portion of my Surveying Manual relating to the subdivision of sections was prepared, I was fully aware of the conflicting statutes in two or three of the public land States, and also of the practice of some county surveyors at variance with the rules laid down therein; but no amount of erroneous practice could be substituted for the law; the rules to be of any value must be based upon the laws of the United States. And I entertained the hope, and do still, that when the subject is fully considered and understood, the erroneous practice of the past will be discontinued.

The chief difficulty, I think, in subdividing fractional and whole sections, has grown out of an endeavor on the part of some county surveyors to make what appeared to them to be an *equitable* subdivision rather than one which should strictly conform to the law in the case. While this course may have been complimentary to the hearts of such surveyors, it by no means makes their work correct. Law and equity are not always the same thing. A law which is just and equitable in the main, may and often does work a hardship in individual cases. The land laws of the United States afford many illustrations of this truth. The proper subdivision of a section where one of the original quarter section corners was erroneously established several rods to one side of the centre, is an example. There is enough land in the whole section to make an *equitable* division, and give to the purchaser of each quarter 160 acres, and yet this cannot lawfully be done. Two of the quarters must contain more than the specified quantity, and the remaining two, less.

The same principle holds good in regard to subdividing fractional sections. The law of Feb. 11, 1804, is very explicit on the subject. It provides that the lines shall be run on "due courses," This is the express language of the statute, and I know of no reason for supposing it does not mean what it says.

It is to be presumed that the exterior lines of a given fractional section established by a U. S. deputy surveyor were run in accordance with the law of Congress. If they were so run, then they are due east-and-west, or north-and-south lines; but even if they were not run as the law says expressly they shall be, the failure of the deputy surveyor to do his work correctly, is no license to the county surveyor to disregard the plain letter of the law in running the subdivision lines. The running on an "intermediate" course instead of a "due course," in such cases, must rest upon the absurd hypothesis that "two wrongs make a right;" *i. e.* an intermediate course between two wrong courses make a right course. The fallacy of this reasoning must be apparent. No right action can be based upon wrong action—no correct work can rest upon erroneous work.

I sincerely hope that these surveyors who take issue with you in the matter, will not rest upon the practice of anyone, but will carefully examine the law for themselves, without prejudice, and with a desire to arrive at a correct conclusion. The fact that the government, in all its departments which have anything to do with these matters, is opposed to the mode of subdividing fractional sections which they claim to have been established by practice, ought to have sufficient weight to elicit a careful investigation of the subject.

I am aware of the obstacles in the way to prevent arriving at a correct conclusion. Surveyors have conscienciously run many lines on "intermediate" courses, and now to adopt the mode of running on *due* courses, would be to acknowledge that all their previous work was wrong. But the matter is one of great importance as affecting future interests, and any surveyor can better afford to do his work right, than to persist in following any practice, however universal, when he becomes convinced it is wrong.

Very Respectfully,
Your obt. servt,
J. H. HAWES.

It seems to me that after reading the law as given above, and the comments of MR. HAWES upon the same, as also the decision of the Commissioner of the General Land Office, it is in rather poor taste for Mr. Hall to speak of the "*Hawes Rule.*" The "rule" laid down by Mr. Hawes in his work is simply an enunciation of the law of the land, interpreted, as he says, by "the government in all its departments which have anything to do with these matters."

I will simply add, as a word of advice to those associations of surveyors who expect by resolutions to establish laws governing the boundaries to lands, a repetition of a sentence from Mr. Hawes' letter: "Any surveyor can better afford to do his work right, than to persist in following any practice, however universal, when he becomes convinced it is wrong."

Respectfully,
HIRAM W. BARNEY.

Stadia Measurements.

MOLINE, Dec. 28th, 1874.

MR. EDITOR:

In regard to stadia measurements, I have micrometer wires in both transit and level, and find that I can depend upon the results to within .2 of a foot in 300 feet, the observations with the level being much the most accurate, there being facilities in that instrument for fixing it firmly so that one of the wires will remain upon a division of the rod while the position of the other wire is observed, or a mark as the edge of a piece of paper is slid to the proper place on the rod by the assistant. We have some very rough land among the Mississippi bluffs, and I have sometimes measured across precipitous ravines with greater certainty, I think, than could have been obtained with the chain. In running lines of the lands I am called upon to survey, the outfit is generally the transit, a Gunter's chain, and a pair of ordinary sighting staves painted red and white in one foot lengths, alternately. When it is desirable to use the micrometer, a staff is held at the farther end of the chain, which is drawn taut from the plumb line of the transit; then the wires are made to intersect exactly, two of the division lines one foot apart; the flagman is then sent over the ravines or other impassable space, and is set in the line which is being run; the transit man having fixed the upper wire on one of the upper divisions of the staff, the flagman is directed to slide a piece of paper downwards until its edge comes into the line of the lower micrometer wire; the feet will of course be the chains, and the remainder measured with a pocket rule gives the inches and parts of the same, which reduced to 1-100ths of a foot gives the links. The practical difficulty with me is that (my transit being a plain one) the telescope is liable to slight vertical movements during the observation. Those which have clamp and tangent screw arrangements to the vertical movements would obviate this difficulty. D. G.

MORENCI, Nov. 9, 1874.

MR. EDITOR: In answer to E. B. O., the tables on page 95 were calculated by approximate methods and are not correct. Below you will find a table of tangential distances calculated by the following method:

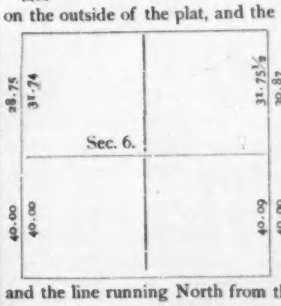
Cosine of lat. of south Bdy.: Cosine of lat. of north Bdy.:: distance on south Bdy.: distance on north Bdy. The difference is the convergency of the meridians for said distances. One half this is the tangential distance to be set off to the north in projecting a parallel of latitude.

Table of tangential distances to be used in projecting the 42nd parallel of latitude.

Miles E. or W.	Miles E. or W.	Miles E. or W.
½ = .002 ch.	2½ = .057 ch.	4½ = .185 ch.
1 = .009 ch.	3 = .082 ch.	5 = .228 ch.
1½ = .020 ch.	3½ = .111 ch.	5½ = .276 ch.
2 = .036 ch.	4 = .146 ch.	6 = .328 ch.

Ordinates at every ½ mile.

Miles E. or W.	½	1	1½	2	2½	3	3½	4	4½	5	5½
½	.002	....	....	....	....	....	....	....	....	....	....
1	.005	.005	....	....	....	....	....	....	....	....	....
1½	.007	.009	.007	....	....	....	....	....	....	....	....
2	.009	.014	.014	.009	....	....	....	....	....	....	....
2½	.011	.018	.020	.018	.011	....	....	....	....	....	....
3	.013	.023	.027	.027	.023	.013	....	....	....	....	....
3½	.016	.027	.034	.036	.034	.027	.016	....	....	....	....
4	.018	.032	.041	.045	.045	.041	.032	.018	....	....	....
4½	.020	.036	.048	.054	.057	.054	.048	.036	.020	....	....
5	.023	.041	.055	.064	.068	.068	.064	.055	.041	.023	....
5½	.025	.045	.061	.073	.082	.082	.080	.073	.061	.045	.025
6	.028	.050	.068	.082	.091	.095	.091	.082	.068	.050	.028



Your answer on page 95 to M. F. M., in regard to restoring lost corners on Township lines is very good as a general rule but it seems to me there are certain cases in which it would greatly change the original lines.

Let me give you an example in Sec. 6, T. 9 S., R. 2, E. Meridian of Michigan, (See annexed plat.) the government distances are placed on the outside of the plat, and the last survey on the inside, you will notice a palpable difference, particularly on the West side, north of the ¼ post; late surveys show that sections east of Sec. 6 agree very closely with the original figures and the line running North from the N. W. corner of Sec. 6, agrees with the government notes closely. You will see at a glance that if this N. W. corner should be lost and an attempt be made to restore it by running a meridian line and dividing the distance *pro rata* that this corner would have to come a long way south of its present position, but by running an East and West line to the nearest monument, its position would be retained. What are your opinions in this case? J. B.

ANS.—We acknowledge the difficulties of this case. If there were no good evidence by which to restore the lost corner we would leave it to the judgment of the surveyor. By examination of the government distances given in the sections surrounding the one in question, and comparing such as he might deem necessary to a decision, by actual measurement a careful man would most likely do right. There are cases where, after all, the good judgment and common sense of the surveyor must be the principal guides to a correct decision. ED.

Personal.

The partnership which heretofore existed between the proprietor of this journal and Chas. J. Moore, C. E. was dissolved December 1, 1874, the latter gentleman having accepted an offer from one of the largest manufacturing firms in New York City, of an important position in their establishment, and he will return to that city as soon as he has completed a series of scientific investigations, on which he is now engaged, for one of the leading Chicago dailies.

Mr. Moore as a thoroughly educated civil and mechanical engineer, and a gentleman of refinement and culture, is calculated to do honor to the engineering profession. It is expected that he will retain a connection with more than one of our daily newspapers, and also from time to time be a contributor to the columns of "THE ENGINEERING NEWS."

John Dunn, Esq., Attorney at Law, who has furnished the matter for our columns of "Law and Legislation," has removed from New York to Chicago, to occupy a position in the office of the President of the Illinois Central Railroad Company; he will, however, continue to supply our journal as heretofore, and will also contribute occasional articles on the jurisprudence of surveys.

Civil Engineers' Club of the Northwest.

The January meeting was held on the evening of Tuesday, the 5th inst., at the Club Rooms, 145 Clark street, commencing at 5.30 o'clock. The President, E. S. Chesbrough, occupied the chair. There were present nineteen members and one visitor.

After the minutes of the last meeting were read and approved, L. S. Olmstead, Chief Engineer of the Chicago and South Atlantic R. R., and Michael A. A. Meyendorff were proposed as members.

C. J. Moore, C. E., then read a paper on "The Relation between Aesthetics and Economy in Construction," which was discussed by the Club; after which S. A. Clemens, of Chicago, read a paper on a new system of Transportation, devised by himself, and called "The Rollway," the details of which were illustrated by drawings, and further explained by Mr. Clemens in the discussion that followed the reading of the paper.

A letter was received from W. S. Pope, Esq., Pres't of the Detroit Bridge Works, announcing the death of Col E. D. Mason, a member of the Club, on the 19th of December last, at Toledo, Ohio. Col. Mason was Chief Engineer of the St. Joseph Bridge, and a valued member of the Civil Engineers' Club. Messrs. Robert Harris, Sup't of the C. B. & Q. R. R., W. S. Pope, of Detroit; and Gen. W. S. Smith, were appointed a committee to prepare a memorial, to be presented at the next meeting of the Club.

A vote of thanks was given to Mr. Clemens for his paper, and the Club adjourned.

"*The Engineering and Mining Journal*," published weekly, at 27 Park Place, New York, has just entered on its nineteenth volume. It is devoted to Mining, Metallurgy, and Engineering, and is the official organ of the large and influential association known as the "American Institute of Mining Engineers," the success of which is largely due to its powerful aid The name of its chief editor, Rossitter W. Raymond, U. S. Commissioner of Mining Statistics, and one of the most accomplished of American writers, is a guarantee of the value of the "Journal" as a record of the mining enterprise of the country, and of its reports of the leading markets in coal and iron.

No. 1, Vol. 19, has two finely executed double page illustrations of coal-working machinery.

The subscription price of the paper is four dollars.

The Academy of Sciences.

The annual meeting of the Chicago Academy of Sciences was held last evening at its rooms, No. 263 Wabash avenue. Dr. H. A. Johnson oecupied the chair.

Dr. Velie reported several additions to the museum.

A number of contributions to the society's library were also reported.

Dr. J. J. Brown and Mr. W. C. Egan were elected members of the society.

The Treasurer presented a report for the year 1874. It exhibited expenditures amounting to $11,013.15, and the receipt of $10,407.70, leaving a deficit of $605.45 due the Treasurer. The report stated that during the past two years the Society had been in arrears, and the Trustees had been obliged to mortgage the Academy property for $20,000. Subscriptions or life-memberships should be obtained, it urged, in order to realize a sufficient sum to carry the Academy through its present financial embarassment.

Messrs. Levi Z. Leiter, Sidney A. Kent, and Joseph A. Devol, by the payment of $500 each, had become life-members of the Society.

The election of officers for this year was then proceeded with. It resulted as follows:

President—Dr. H. A. Johnson.
First Vice President—E. W. Blatchford.
Second Vice President—H. H. Babcock.
Recorder—Dr. N. Bridge.
Librarian—Dr. J. W. Velie.
Committee on Membership—Messrs. Andrews, Blatchford and Hancock.
General Committee—Messrs. Walker, Ebert, Bross, Durham, Chesbrough and Hollister.

Mr. E. W. Blatchford stated that Saturday an expedition will leave Chicago, under the auspices and for the benefit of the Chicago Academy of Sciences, for the purpose of making investigations in natural history, and making collections of specimens in Florida and the gulf-stream, and the reefs and keys adjacent. The company will consist of the following members of the Academy: Dr. J. W. Velie, in charge of the ornithological department; Mr. W. W. Calkins, in charge of the conchological, and Dr. J. J. Brown, in charge of the botanical departments.

They will have a full outfit for collecting, and for dredging in the gulf-stream.

A letter was read from Dr. Winship, descriptive of mounds and skulls found in Bureau County.

A letter was also read from Mr. Lyman C. Draper, of the Wisconsin Historical Society, asking for information regarding the discovery of mastodon remains in that State. It was addressed to J. A. Noonan, by whom it had been referred to the Chicago Society.

Mr. W. W. Calkins exhibited the inferior maxillary of a human being found in a drift near Ottawa, 50 feet below the surface.

Mr. Wescott presented a specimen of Squilla Impusa, a variety of the lobster species, from Narragansett Bay.

The Society then adjourned.

Dominion News.

Messrs. T. N. Snyder, J. D. Ripley, Jas. McIntyre M. Dowling, and W. P. Kennedy, contractors from New York, have been looking after Canadian contracts lately.

The engineers of the Huron and Quebec Railway reached Franktown Dec. 14. The route so far surveyed is all that could be desired.

The survey of the Northern Colonization Railroad extension from Aylmer to the mouth of the river Mattawan, is just completed. The section can be built for $28,000 per mile.

The southern extension of the Wellington, Grey, and Bruce Railway was opened Dec. 25th.

RAILWAYS IN ONTARIO.—Railways are being developed in Ontario with a certain rapidity. The lines completed cover 2,445 miles, while there are 660 miles under construction. It is estimated that the expenditure on railway construction for the present year will be $2,000,000, while to complete lines already in progress some $10,000,000 will be required.

STEEL RAILS FOR THE CANADIAN PACIFIC.—It is stated that 40,000 tons of steel rails have been purchased for the Canadian Pacific Railway. The purchase price, it is further intimated, is $54 per ton, delivered in Montreal.

NORTHERN COLONIZATION RAILWAY.—Mr. Legge, Chief Engineer of this road, is of the opinion that trains will be running on it between Ottawa and Montreal by October next. Contracts have been entered into for 16 locomotives; also for iron bridges for all spans from 50 feet upwards. The steel rails required for the track have already been shipped from England.

Railroad News.

The Nevada Narrow Gauge Railroad is a certainty —the contract is let for its construction and equipment. It runs from Nevada to Colfax. A road from Nevada to Marysville will soon be found a necessity.

It seems to be pretty well determined that considerable railway building will be done in southern Colorado during the coming season. The Denver and Rio Grande will be extended from Pueblo to Trinidad —a distance of one hundred miles or thereabouts. The Pueblo and Salt Lake railroad, as it is called—really the Atchison, Topeka, and Santa Fe—will be completed from its present terminus at Grenada to Pueblo, a distance of one hundred and fifty miles more or less.

The first twelve miles of the Utah Western railroad has been completed and opened for business. The board of officers and directors is as follows: President, John W. Young; Vice President, Hiram B. Clawson; Secretary, J. N. Pike; Treasurer, H. B. Kimball; Directors, S. D. Connor, G. W. Thatcher, W. C. Rydlock, Peter Clinton, S. B. Young, and A. C. Pyper. The Superintendent is H. P. Kimball, with George W. Thatcher, Assistant. The company was organized June 15th last, with a capital of $900,000, in shares of $100 each. They purchased the interest of the Salt Lake, Seveir Valley and Pioche railroad, which was organized in 1872. It is a narrow gauge (three feet) track, and is completed to within a mile of Chambers' stage station. It will be continued with as little delay as possible to Lake Point (Clinton's), and thence to Stockton.

Cleveland, Ohio.

From the reports of the various departments of the Government of the above named City, for the year ending Dec. 31, 1873, and just published, we make the following summary of the Report of the City Civil Engineer, Chas. H. Strong, Esq., to whose kindness we are indebted for the copies sent us.

On January 1, 1874, the City of Cleveland contained within its corporate limits about 25 square miles of territory, which it was expected would be increased during the year to 29 square miles. There were 3.93 miles of streets graded and paved with wood and stone, at a cost of $225,570.41; grading and curbing 10.23 miles more cost 72,827.08; total paved streets Jan. 1, 1874, was 40 8-10 miles; the estimated cost of street improvements, under contract, and in progress, was $433,519.98, of which $171,480.24 was completed; openings and extension of streets cost $733,011.46 more; of sewers completed there were 24,807 ft. costing $89, 346.88; 26,935 ft. more were under contract and in progress, the estimated cost of which was $254,147.00, of which $33,278.97 were completed; total sewers constructed in 1873 5.38-100 miles; total sewers in city 51 miles. Miscellaneous engineering work cost $112,492.55; Engineering department cost $21,318.12, of which $4,000 was paid as salary to the City Engineer, and $15,921.46 to his Assistants.

The following valuable extracts are reprinted from the Report of the City Engineer, as given:

Stone Paving—But one quality of stone is used for paving purposes, and that is procured from the Medina quarries in the State of New York. It is a sondstone of a close, hard formation, splits freely, is not affected by frost, and becomes harder by use. Forty-two thousand two hundred and four (42,204) square yards of this pavement has been laid during the past year, at an average cost of about one dollar and eighty-five cents ($1.85) per square yard, including ballast. The ordinary manner of preparing and laying the pavement is as follows: The stone are broken as nearly rectangular as can be done economically, and vary in thickness from two to four inches, the length ranging from four to ten inches, and about eight inches in depth. The stone are placed upon a bed of ballast twelve inches in depth, and driven to a uniform surface and bearing, with a paver's maul, weighing from sixty to eighty pounds. The stone not being uniform in thickness, there is consequently a corresponding variation of the spaces between them, which are filled with gravel; and it is this inequality which causes the pavement to wear irregularly and uneven. To obviate these defects and make a durable and smooth pavement, I prepared plans and specifications as follows, for the re-paving of Euclid avenue between Monumental Park and Erie street, viz: The stone to be of the uniform depth of eight inches, to be not more than two and one-half inches nor less than two inches in thickness; to be dressed smooth all around with parallel sides and ends; the stone to be placed in rows of uniform thickness across the street; no sand or gravel to be placed between or on top of the stone while setting the same. The whole surface is then thoroughly pounded to conform to the grade and cross-section of the street. In the actual working of the stone it was found impracticable, with the tools used for dressing them, to make the stone conform to the specifications. A compromise was therefore made, and the contractor allowed to proceed with the work; but before the work was one-half completed, the contract was abandoned, and the Engineer proceeded to complete the work. The price at which this paving was contracted was two dollars and thirty cents per square yard, but paving of this character cannot be put down for less than three or three dollars and a quarter per square yard. A pavement of this discription, however, if not broken up or disturbed, would unquestionable wear for thirty or forty years without being re-laid.

Stone and Wood Paving Combined.—The plan of combining wood and stone paving was adopted some three years ago, and since that time on all the streets on which wood has been used for paving purposes, the wood has been placed in the central portion of the roadway, the sides and gutters being paved with stone. The wood portion is usually from one-half to three-fourths the width of the roadway. The advantage to be gained in having the sides paved with stone are these: Experience has proven that where the full width of the roadway is paved with wood, the central portion receives four-fifths of all the travel, thus leaving the sides of the roadway to become worthless from decay, while the central portion is being worn out. By using stones for the sides the wood portion can be renewed whenever desired, without disturbing the stones at the sides.

The Nicholson is used almost exclusively in the city. The first wood paving was laid eight years ago the coming summer, and the pavement is so badly decayed that it will have to be replaced this year. Wood for street paving, as originally prepared and laid, has proved a total failure here. Two years ago last season, St. Clair street from Erie street to Wilson avenue, a distance of some two miles, (excepting the square from Alabama to Minnesota st.), was paved with blocks treated by a resin process known as the Detwiller and Van Gilder patent. Sufficient time, however, has not yet elapsed to determine the success of the process, and as the process is entirely new, (this being the first test ever made), time is the only criterion by which to determine its merits. The process, in short, is to expel the sap from the wood by heat, and fill the pores with a solution of resin and naphthaline, thus making the blocks impervious to water.

The square above referred to was paved (with blocks treated by the Thilmany process) at the same time the balance of the street was paved. The process is one of that class which has a metallic salt for its base, and the treating is done in the following manner: The blocks are placed in a strong wood or copper tank, and direct steam applied to expel the sap and moisture and coagulate the albumen. When sufficiently heated for that purpose, a vacuum pump is applied for the purpose of removing all moisture from the pores of the wood. The tank is then filled with a hot solution of the sulphate of copper (blue vitrol) and water, and the force pump applied until the blocks are saturated with the solution. The solution is then drawn off, the vacuum pump attached, and the moisture again drawn from the blocks. The tank is then filled with a solution of chloride of barytes and water, and the force pump again applied, and the process is completed. The chemical combination resulting from the foregoing operation is the deposit of an insoluble salt in the cellular tissues of the wood, known as the sulphate of barytes. It is upon the insoluble nature of this salt and the copper retained in the fiber of the wood that the preserving properties of this process de-

pend. This process has for a long time successfully used in the old German states, for preserving railway ties, telegraph poles, etc., but has never been tested before for street paving purposes. I have in my office a railway tie treated by the Thilmany process, that was taken from the track of the Eastern District railway of Bavaria, February 3d, 1873, having been in constant use over sixteen years, and is as sound as when first placed in the track. I have also examined some ties now in the track of the Cleveland and Pittsburgh railway at Euclid avenue crossing. These ties are white beach, elm, soft maple, cucumber, and whitewood, and were treated by the Thilmany process nearly five years ago, and have been in constant use ever since. These ties are as sound and perfect as the day they were placed in the track. A process that will produce such results upon the most perishable wood when used as railway ties, will certainly warrant the conclusion that similar results must necessarily follow its use when applied to wood for street paving purposes.

Franklin street, from the Circle to Harbor street, about one-half a mile, was paved last season with the Alexander Miller wedge block pavement, treated by the Seely and Pelton (dead oil) process. This was laid as a sample pavement, and no expense or care was spared to make it the best that could be made. It is being used extensively in Pittsburgh, and has also been laid in New York City. Five thousand and fifty-seven square yards of the wedge block pavement have been laid in this city. Of the Nicholson patent, treated by the Thilmany process, thirty-four thousand eight hundred and fifty six square yards were laid the past year, and contracts covering nearly nineteen thousand square yards have been made for the coming season.

Concrete Pavement.—In July, 1871, a sample of Abbott's concrete pavement was laid on top of the stone paving in Superior street, on the east side of Monumental Park. The concrete, thus far, has not shown the least indication of wear or defect of any kind. The present indications are that the pavement will prove a success, although it has not had sufficient time to give it a thorough and satisfactory test.

Concrete pavements have in a majority of cases proven a total failure in this country. There is evidently a want of knowledge or skill in the construction of this class of pavements, for it is not an uncommon occurrance to see two pieces of paving evidently laid with the same care, and purporting to be precisely of the same material, yet one may prove a success and the other a total failure. It is this uncertainty that prevents its being more generally adopted, for it is superior to all other pavements in point of smoothness and cleanliness, and if it could always be relied upon, it would be more universally adopted.

Macadamized Roads.— A Macadam road, well constructed, of good material, can hardly be excelled for the suburban districts. Several streets in East Cleveland, previous to annexation, were Macadamized, but it has, to a great extent, proved a failure, by reason of defective construction, and the use of improper material, From none of the quarries in the vicinity of the city can stone be obtained sufficiently hard and suitable for Macadamizing purposes.

In view of the increasing demand for Macadamized streets, a steam road roller, weighing fifteen gross tons, was purchased by the city last season. The roller is of English manufacture, (Averling & Porter, London), and does its work in a very satisfactory manner.

The most objectionable feature of Macadam roads is the constant repairs that are necessarily required to maintain them in good condition, and unless these repairs are promptly made, the road is soon worn into ruts and is rapidly destroyed.

The Royal Society of London.

We have only to turn over the pages of its transactions to discern how much this society has done for the progress of humanity. It was incorporated in 1662, and has interested itself in all the great scientific movements and discoveries that have since been made. It published Newton's "Principia;" it promoted Halley's voyage, the first scientific expedition undertaken by any government; it made experiments on the transfusion of blood, and accepted Harvey's discovery of the circulation. The encouragement it gave to inoculation led Queen Caroline to beg six condemned criminals for experiment, and then to submit her own children to that operation. Through its encouragement Bradley accomplished his great discovery, the aberration of the fixed stars, and that of the nutation of the earth's axis; to these two discoveries, Delambre says, we owe the exactness of modern astronomy. It promoted the improvement of the thermometer, the measure of temperature, and in Harrison's watch, the chronometer, the measure of time. Through it the Gregorian Calendar was introduced into England, in 1752, against a violent religious opposition. Some of its Fellows were pursued through the streets by an ignorant and infuriated mob, who believed it had robbed them of eleven days of their lives; it was found necessary to conceal the name of Father Walmesley, a learned Jesuit, who had taken a deep interest in the matter; and Bradley happening to die during the commotion, it was delared that he had suffered a judgment from Heaven for his crime.

If I were to attempt to do justice to the merits of this great society, I should have to devote many pages to such subjects as the achromatic telescope of Dollond; the dividing engine of Ramsden, which first gave precision to astronomical observations; the measurement of a degree on the earth's surface by Mason and Dixon; the expeditions of Cook in connection with the transit of Venus; his circumnavigation of the earth; his proof that scurvy, the curse of a long sea voyage, may be avoided by the use of vegetable substances; the polar expeditions; the determination of the density of the earth by Maskelyne's experiments at Schehallion, and by those of Cavendish; the discovery of the planet Uranus by Herschel; the composition of water by Cavendish and Watt; the determination of the difference of longitude between London and Paris; the invention of the voltaic pile; the surveys of the Heavens by the Herschels; the development of the principle of interference, by Young, and his establishment of the undulatory theory of light; the ventilation of jails and other buildings; the introduction of gas for city illumination; the ascertainment of the length of the seconds-pendulum; the measurement of the variations of gravity in different latitudes; the operations to ascertain the curvatures of the earth; the polar expedition of Ross; the invention of the safety lamp by Davey, and his decomposition of the alkalies and earths; the electro-magnetic discoveries of Oersted and Faraday; calculating engines of Babbage; the measures taken at the instance of Humboldt for the establishment of many magnetic observatories; the verification of contemporaneous magnetic disturbances over the earth's surface. But it is impossible, in the limited space at my disposal, to give even so little as a catalogue of its transactions. Its spirit was identical with that which animated the Accademia del Cimento, and its motto accordingly was, "Nullius in Verbia." It proscribed superstition, and permitted only calculation, observation and experiment.—*Prof. Draper.*

A company is being formed to build another bridge over the St. Lawrence at Montreal. Mr. Legge is the Engineer. A charter will be secured at the coming session of Parliament.